One possible explanation for the origin of the e21 ^{132}Xe anomaly, suggested by Yaniv *et al.* (to be published), is that it arises from low energy (~ 20-40 MeV) proton reactions on REE-rich interstellar grains. The reactions ^{139}La(p,2α)^{132}Cs(β^+)^{132}Xe and ^{140}Ce(p,n2α)^{132}Cs(β^+)^{132}Xe would be required to dominate. It is noteworthy that one of the few high temperature phases which is compatible with peak release temperatures above 1500 °C is perovskite, for which the REE have an affinity, suggesting that it may be the carrier phase for the ^{132}Xe anomaly.

El Goresy, A., K. Nagel, B. Dominik and P. Ramdohr, 1979. *Meteoritics* **14**, 390.
Jessberger, E.K. and B. Dominik, 1979. *Nature* **277**, 554.
Jessberger, E.K., B. Dominik, Th. Staudacher and G.F. Herzog, 1980. *Icarus* **42**, 380.
Mason, B. and P.M. Martin, 1977. *Smith. Cont. Earth Sci.* **19**, 84.

RARE EARTH ELEMENTS IN ACID LEACHES AND RESIDUES FROM WHOLE ROCK AND MINERAL SEPARATES FROM LUNAR BASALT 75055

S. Jovanovic and G.W. Reed, Jr., *Chemistry Division, Argonne National Laboratory, Argonne, IL 60439*

Mineral separates from basalt 75055 were leached for ~ 10 minutes with hot H_2O and then for the same time with 0.1 N HNO_3 to remove in the first case H_2O-soluble phases, in particular, and in the second to determine Cl and P_2O_5 association with the minerals. The 0.1 N acid leach dissolved ~ 40% of the non-H_2O soluble fractions of these elements. The Cl/P_2O_5 ratio was close to that of the residue after the 0.1 N HNO_3 leach suggesting the same mineral, apatite, as the source of these elements. This result prompted us to extend the experiment to examine the REE since in lunar material REE and P are associated with the phase designated as KREEP. U, also KREEP related, was already being measured.

Five samples were measured: a whole rock aliquant, a residue from the mineral separation, 95-99% pure pyroxene and plagioclase phases and an ilmenite-rich phase. Significant fractions of REE were leached with 0.1 N acid, but there appears to be no consistent relationship between REE and P_2O_5. Relative to W.R., the acid leaches and residues from mineral separates appear depleted in HREE. Relative to W.R., an enriched HREE component is found in the residue from the mineral separation after it was leached with 0.1 N acid. These observations and a number of others will be elaborated on; they indicate a complex association of REE with basalt components. Although pyroxene is the main major mineral repository for REE in the basalt, about 1/3 of the REE were leached in 10 minutes with 0.1 N acid, a treatment which would not be expected to attack the pyroxene.

HOBA AND TLACOTEPEC: TWO NEW METEORITES WITH ISOTOPICALLY ANOMALOUS Ag

T. Kaiser and G.J. Wasserburg, *The Lunatic Asylum, Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA 91125*
W.R. Kelly, *Center for Analytical Chemistry, National Bureau of Standards, Washington, DC 20234*

Excesses of ^{107}Ag/^{109}Ag (^{107}Ag*) of up to 4% relative to terrestrial silver were discovered by Kelly and Wasserburg (1978) in the Santa Clara iron meteorite. Subsequent investigations by Kaiser *et al.* (1980) (hereafter KKW) revealed much larger ratios of ^{107}Ag/^{109}Ag and showed that the true ^{109}Ag concentration was at a very low level for both the Piñon and Santa Clara iron meteorites. Experiments on other iron meteorites were indicated in order to further clarify the role of extinct ^{107}Pd as the source of the ^{107}Ag excesses compared to other possible sources. We present new results on the Hoba, Tlacotepec, and Canyon Diablo iron meteorites. Using our surface decontamination procedure we find Ag concentration levels in Hoba and Tlacotepec, two IVB iron meteorites, which are smaller by 1-2 orders of magnitude than reported earlier (Kelly *et al.*, 1977, hereafter KTW). The new ^{109}Ag concentration levels found for Hoba and Tlacotepec ($1.0 \pm 0.04 \times 10^{11}$ and $2.2 \pm$ p.1 $\times 10^{11}$ atoms/g respectively, corrected for blank) are essentially identical with the levels found for Piñon and Santa Clara. At the same time the ^{107}Ag/^{109}Ag ratio for Hoba and Tlacotepec was discovered to be distinctly different from normal (2.92 ± 0.09 and 1.113 ± 0.014, respectively, corrected for blank). The large decrease in Ag concentration found for IVB meteorites compelled us to check the high levels found for other meteorites by using our surface decontamination procedure. The results for Canyon Diablo, a IA iron meteorite, which were done

after strong etching, confirm the earlier high levels of concentration (by Smales *et al.*, 1967, and KTW) and also confirm the normal isotopic composition for this meteorite clan.

From these data it appears that ^{107}Ag excesses are a common feature of the IVB meteorites. Hoba has a $^{107}Ag^*/^{108}Pd$ ratio of 1.7×10^{-5} with a short galactic cosmic ray (GCR) exposure age of 0.3 AE (Voshage and Feldmann, 1979). Piñon has approximately the same $^{107}Ag^*/^{108}Pd$ ratio but an exposure age of 0.8 AE. Furthermore Tlacotepec shows a small ^{107}Ag excess (2%) with nearly the same Pd/Ag ratio as the other IVB meteorites and with an exposure age comparable to that of Piñon. The analyses of spallation gases on specific samples analyzed here, reported by Villa *et al.* (1980) show considerable differences in GCR secondary particle fluences for these samples, indicating no correlation between ^{107}Ag excesses and cosmic ray exposure. These observations appear to rule out significant contributions from GCR secondary neutrons on Pd as the cause for the ^{107}Ag excesses. This possibility was discussed earlier by KKW who showed that the multiplicity times the cross section would have to be ~ 100 barns in order for there to be a dominant contribution of such secondary nuclear reactions. Our recent observations are in accord with the theoretical analysis by Reedy (198) based on the ^{53}Mn production from iron. From direct observation of Ag anomalies in meteorites with different irradiation ages as well as from the estimated production rates of the ^{107}Ag excesses from GCR, the most plausible explanation of the ^{107}Ag excesses still appears to be the decay of extinct ^{107}Pd in the early solar system.

Div. Contrib. No. 3463 (356).

Kaiser, T., W.R. Kelly, and G.J. Wasserburg, 1980. *Geophys. Res. Lett.* **7**, 271.
Kelly, W.R. and G.J. Wasserburg, 1978. *Geophys. Res. Lett.* **5**, 1079.
Kelly, W.R., F. Tera, and G.J. Wasserburg, 1978. *Anal. Chem.* **50**, 1279.
Reedy, R.C., 1980. *Proc. 11th Lunar & Planet. Sci. Conf.* (preprint).
Smales, A.A., D. Mapper, and K.F. Fouchè, 1967. *Geochim. Cosmochim. Acta* **31**, 673.
Villa, I.M., J.C. Huneke, and G.J. Wasserburg, 1980. *Meteoritics* **15**, 382.
Voshage, H. and H. Feldmann, 1979. *Earth and Planet. Sci. Lett.* **45**, 293.

CARBONACEOUS CHONDRITIC MATERIALS IN THE SOLAR SYSTEM

G.W. Kallemeyn, *Institute of Geophysics and Planetary Physics, University of California, Los Angeles, CA 90024*

Carbonaceous chondrites are generally thought to represent some of the most compositionally primitive materials in the solar system. Abundances in the CI group and the Sun are indistinguishable for most elements. Carbonaceous chondrite-like clasts are found in a variety of meteorite groups. These carbonaceous chondritic materials consist of collections of grains formed in or initially present in the primitive solar nebula.

The known carbonaceous chondrite groups form rather discrete compositional clusters in terms of parameters such as refractory and volatile element abundances and oxygen isotopes. Chondrite groups having certain common properties may be linked together into clans. The various compositional clusters probably either resulted from components forming under differing nebular conditions, or initial inhomogenieties in the nebula including the possibility of presolar materials. An important question also arises as to whether the hiatuses between these clusters were present in the spectrum of materials formed some 4.5 Gy ago, or whether they are artifacts due to the incomplete sampling of a continuous spectrum. The thrust of this study was to determine a wide range of elemental abundances (refractories through volatiles) in carbonaceous chondrites. Using this as a base to build upon, nebular models pertaining to the formational processes carbonaceous chondrites and carbonaceous chondrite-like clasts were included in the study as potential "missing links" between clusters.

Twenty "grouped" and four "anomalous" carbonaceous chondrites, along with five carbonaceous chondrite-like clasts, were analyzed by INAA and RNAA for some thirty elements. Refractory element abundances link the four carbonaceous chondrite groups into three clans: CI, CM-CO, and CV. These clans probably indicate formation at different heliocentric distances. Refractory abundances relate to the earliest physical processes in the solar nebula and the possible existence of presolar materials (*i.e.*, Ca, Al-rich inclusions). Volatile element abundances are rather distinct among all four groups and serve to distinguish CM from CO chondrites which are placed in the same clan, on the basis of nonvolatile element abundances. Volatile abundances also relate to nebular processes. They give clues to the spatial and time distribution, efficiency, and extent of the condensation processes taking place in the various formation regions.